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than one-half of that necessarily taken with each pound of grapes, stems and all, sprayed as profusely as those analyzed.

When it is considered that 203 vines received in one season's treatment only 57.25 pounds of copper, or $4\frac{1}{2}$ ounces per vine, the very inconsiderable amount which remains adherent to the berries is not to be wondered at. Although spraying after the middle of July with the Bordeaux mixture is to be avoided, it will be seen that there is no real danger arising therefrom, and when the ammoniacal solution is substituted for the last three sprayings, since it contains only $\frac{1}{32}$ as much copper, there can be no possible danger.

DISEASES OF THE GRAPE IN WESTERN NEW YORK.

Numerous complaints having been received from correspondents in various parts of western New York of a disease which was seriously injuring grape vines, it was decided to send some one into the field to investigate the matter. Accordingly, on October 18, Mr. D. G. Fairchild was directed to visit Lockport, N. Y., and such other points within the State as might be necessary, and to obtain such information and make such investigations as would enable him, if possible, to determine the cause of the trouble and suggest a remedy therefor. Below is Mr. Fairchild's report.

B. T. GALLOWAY,
Chief of Division.

WASHINGTON, D. C., *October* 25, 1890.

SIR: In accordance with your instructions, I left Washington on October 18, proceeding directly to Lockport, N. Y., where, through the kindness of the Niagara White Grape Company, I was enabled to obtain much valuable information relative to the new disease of the grape, which is generally referred to under the name of "blight" or "rust." After leaving Lockport several important grape-growing regions were visited, in all of which the new trouble was found more or less abundantly. I submit my report on the investigations made, and also add some notes on other vine diseases which came under my observation.

Respectfully,

D. G. FAIRCHILD,
Assistant.

REPORT.

The attacks of the disease seem to be confined to bearing vines three or more years from planting. So far as known, it has occurred, during the past season, only in the grape-growing districts of western New York, and is now present in Niagara, Wayne, Cayuga, Seneca, Steuben, and Ontario Counties. While it may be presumed that the same trouble exists in the intervening counties, and, perhaps, in other sections along the Great Lakes, it has not been definitely reported from these localities. This year the disease appeared simultaneously in the different districts soon after September 1, and in most of them for the first time, but in one locality, Ontario, Wayne County, it is reported to have appeared for the first time two years ago, when it did considerable damage. One vineyard was observed which was previously affected, and in this the area diseased this year did not appear to be entirely coincident with the portion worst affected two years ago.

CHARACTERS OF THE DISEASE.

Small irregular blotches of a dark color appear between the veins, these enlarge rapidly, darken to a dull purplish or reddish brown and coalesce so as to fill up the space between the veins which remain green or yellow. These changes occur so rapidly that the foliage seems to change color suddenly. The contrast between the green or light yellow veins and dark purplish brown of the intervening tissues gives a peculiar streaked appearance to the leaves. In the most serious cases they curl up, become dry and brittle, and finally drop from the vine, leaving it nearly bare.

The berries borne upon diseased vines, almost without exception, have a flat, insipid, and often intensely sour taste, due to the fact that they are only partially ripened. When the attack is severe the berries drop off, and the ground beneath a diseased vine is often seen to be covered with half ripe grapes. The berry is found to part from its pedicel taking with it the fibers which enter the interior of the pulp and are normally withdrawn from it when the berry is pulled off. After the crop has been harvested, also, the bunches are found to "shell" badly, ruining them for market.

The roots of diseased vines, when carefully examined, fail to show a healthy growth of young feeding rootlets. When the roots of healthy and unhealthy vines are compared, although as is to be expected late in the season (October 20–25) the fibrils have many of them dropped from all vines, the difference in favor of the healthy vines points quite plainly to the fact that root absorption has been stopped earlier where the disease is present. This early stoppage of the action of the rootlets may account for the peculiar coloring of the leaves and failure of the canes to mature their wood.

As will be seen from the following somewhat free translation from Pierre Viala's work (The Diseases of the Vine, p. 432) the malady corresponds in many respects to what this eminent viticulturist calls *Rougeot* and which he considers a mild form of the destructive *Apoplexie* which has been long noticed in France.

> Grape leaves sometimes suddenly assume a red color, especially in midsummer at the heated periods when there are strong dry winds or when the temperature falls suddenly. The leaf tissues become leathery and fragile between the veins, and the color, which normally would be that of a dead autumn leaf, is a bright, almost rose red and at times a wine color, while the veins remain green or yellowish, later the color becomes dull and the leaves dry up.
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> The yellowish shoots dry up, beginning at their bases. But the vine is not diseased beyond recovery as is the case with Folletage. It puts out green branches in the course of the same year and in the following year the only evidence of the disease is a slight weakness of the vine.

G. Foëx, in his Complete Course of Viticulture,* thus describes under the same name a disease which he considers somewhat distinct from *Apoplexie* or *Folletage*:

> Rougeot is a disease which resembles Folletage in the conditions which cause it as well as in its general effects. Like this, it attacks the vine while it is in full growth, at the first heated period, and prevails especially in deep and cold soils.
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> Thiebaut de Berneaud† says that it is produced during the summer after a cold rain, a storm which suddenly lowers the temperature, or even a fog, when these are succeeded by warm south winds.
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> M. Mares‡ gives the following description:
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> "The leaves change, becoming like parchment, and lose their flexibility; the tissue between the nerves becomes red, while the nerves themselves remain green, giving the leaves of diseased vines quite a peculiar appearance; the berries shrivel, the canes remain yellow, and if the malady becomes more severe the leaves dry up entirely and the canes partially die—rotting from the extremity to the base. A vine is sometimes attacked only upon one side, which becomes brown, while the other parts remain green. * * * The vines diseased with rougeot do not die, as in the case of apoplexie, but are much injured, and their natural fertility is considerably diminished, only recovering after several years. Drainage appears to be, as in the case of apoplexie, the best means of diminishing the chances for the development of this malady."

While the above descriptions contain many conflicting statements it is reasonably certain that the malady seen by the various authors is the same and is probably of a like nature to the one in question. Viala in his *Mission Viticole en Amerique* mentions folletage, of which he considers rougeot a mild attack, as occurring in the Atlantic States, especially in the South.

A careful microscopic examination of all parts of the diseased vine has revealed absolutely nothing of the nature of a parasitic fungus which could in any way be connected with the malady. Leaves, canes, and roots seem perfectly free from any form of parasitic plant or animal. However, as this examination was only made late in the season, the decision as to the presence of parasitic organisms can not be considered as final.

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* Cours complet de Viticulture, par G. Foëx, Paris, 1888, p. 421.

† Nouv. Manuel complet du Vigneron francais. Manuels Roret, p. 186, quoted by Foëx.

‡ Des Vignes dans le Midi de la France in le Livre de la Ferme, Paris, Masson, 1865, p. 173, quoted by Foëx.

CAUSES.

On the other hand, circumstances in this case as with the disease in France point to a close relation between the diseased vines and the condition of the soil with regard to drainage. In general it may be said that the worst attacks of the disease occur upon cold, heavy soils containing a large percentage of clay and rich in nitrogenous matters. Of the nine vineyards visited, which were over three years old from planting, seven showed the disease badly, and of these five were not underdrained and the remaining two only partially so. In the two vineyards which were upon high, well drained land the trouble was present only in its mildest form, in fact the attack was so slight that the owners had not noticed it. In one vineyard two adjacent plots, one cultivated for years as the family garden, the other in the regular farm rotation, showed a most striking contrast. The garden plot, although situated nearer the base of the slope, showed no signs of the trouble, while the plot in regular rotation had most of its vines badly diseased. Notwithstanding these facts, however, in particular vineyards the appearance of diseased vines upon its most elevated portions showed the disease was not wholly confined to cold, deep soils.

So far as the investigation goes there seems to be no connection whatever between the fertilizers used and the trouble, diseased plants being found upon land unmanured, heavily manured, fertilized with phosphates, wood ashes, and bone dust. In all cases the soil, although not chemically examined, seemed to be rich in nitrogenous matters and was fertile in every sense. It seemed, however, to lack one element, lime, which had not been applied and was evidently not abundant.

SUGGESTIONS IN REGARD TO TREATMENT.

In cases where the soil is at all inclined to retain more moisture than necessary, thorough underdraining will probably be the surest means of preventing a second attack. Should the vines show no mature wood available for the next year the better plan will be to prune close to the ground and raise an entirely new growth. Where the attack has been slight and enough mature wood remains to grow new bearing canes another season, such severe treatment is not necessary.

In any case, the pruning should be postponed as late as possible in order to give the canes that are still green all possible opportunity to ripen. The diseased vines should not be allowed to bear heavily the coming season, as the necessary strain may favor a second attack of the disease. Further investigations are, of course, necessary to ascertain more definitely the immediate cause of all such maladies.

BLACK ROT.

The presence of this disease was noted in all the counties visited, but its attacks this season have evidently been slight as compared with its ravages farther south, only an occasional cluster being attacked. That the malady has gained a foothold throughout this section can not be doubted, but timely applications of the copper mixtures will, if early undertaken, prevent severe ravages in future seasons.

ANTHRACNOSE.

Found sparingly at Fair Haven, Lyons, and Romulus, where it had damaged the fruit principally, only an occasional cane being affected.

DOWNY MILDEW.

This disease appears to be one of the worst pests of the New York vineyardist, presenting itself in the form of gray rot or brown rot in most of the vineyards visited, but as far as seen doing only slight damage to the foliage.

POWDERY MILDEW.

Numerous cases of this fungus were seen in almost every vineyard examined, except those sprayed with some of the copper mixtures. The fruit where attacked becomes discolored, and accumulations of dust which can not be removed occur upon the diseased portions rendering the clusters unfit for market.

GRAPE GLŒOSPORIUM.

This disease,* to be described in another number, although a new one, should be carefully looked after. It was noted in every packing house visited, and although any of the copper remedies would doubtless check its ravages it is likely to prove a troublesome pest.

GRAPE CLADOSPORIUM.

Upon two vines of Clinton in Cayuga County the immature stage of a species of *Cladosporium* was noticed in connection with powdery mildew. The berries attacked assumed a dirty orange-yellow hue, became rough and unsightly, and were ruined for market purposes. It is hoped that the mature spores of this fungus may be found and the species identified, but as yet only the mycelial form has been seen forming a thick felt composed of much torulosed mycelium upon the epidermis of the berry.

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*Ann. Report, 1890.